FIG. 1

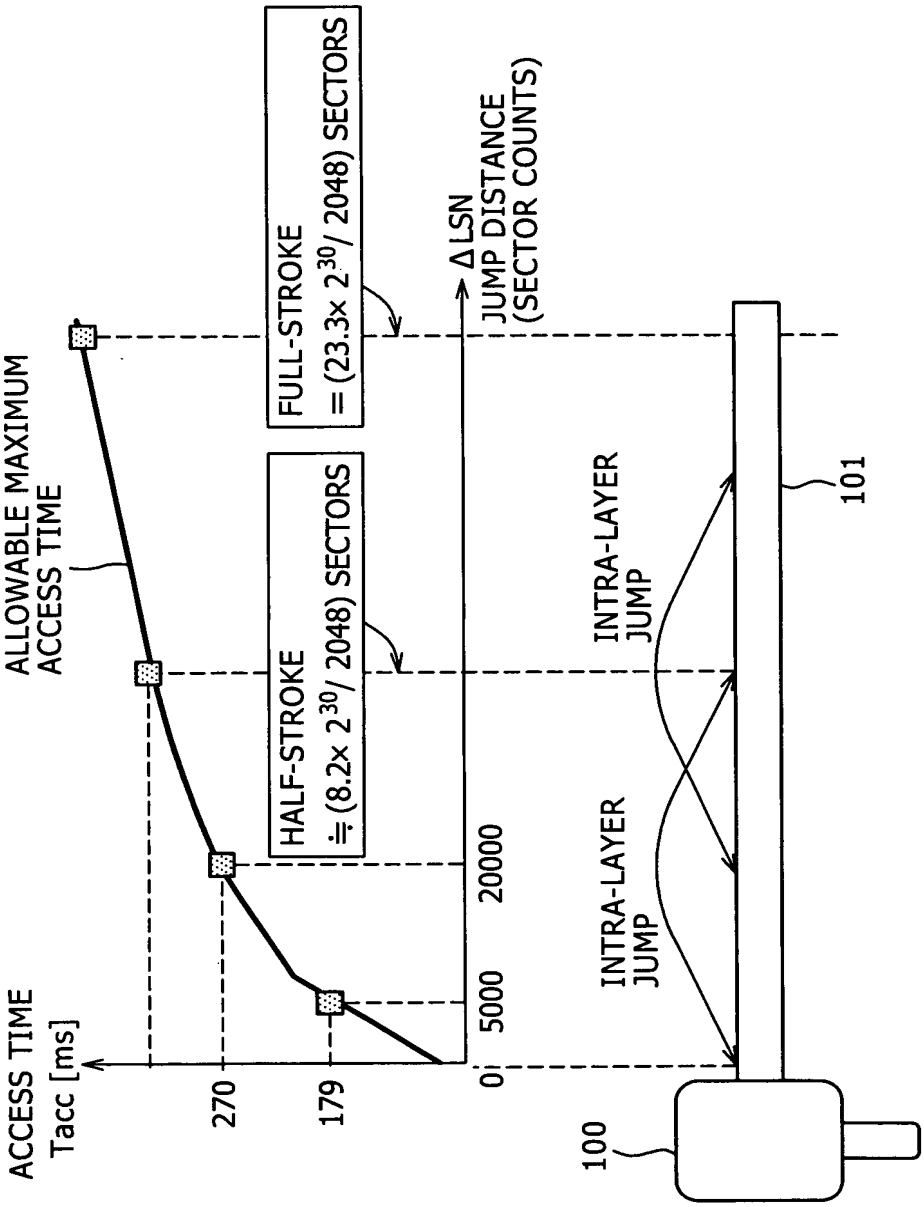

ALLOWABLE MAXIMUM ACCESS TIME
ACCESS TIME Tacc [ms]
270
179
0
5000
20000
ΔLSN JUMP DISTANCE (SECTOR COUNTS)
FULL-STROKE = (23.3× 2^30/ 2048) SECTORS
HALF-STROKE ≒ (8.2× 2^30/ 2048) SECTORS
INTRA-LAYER JUMP
INTRA-LAYER JUMP
100
101

FIG. 2

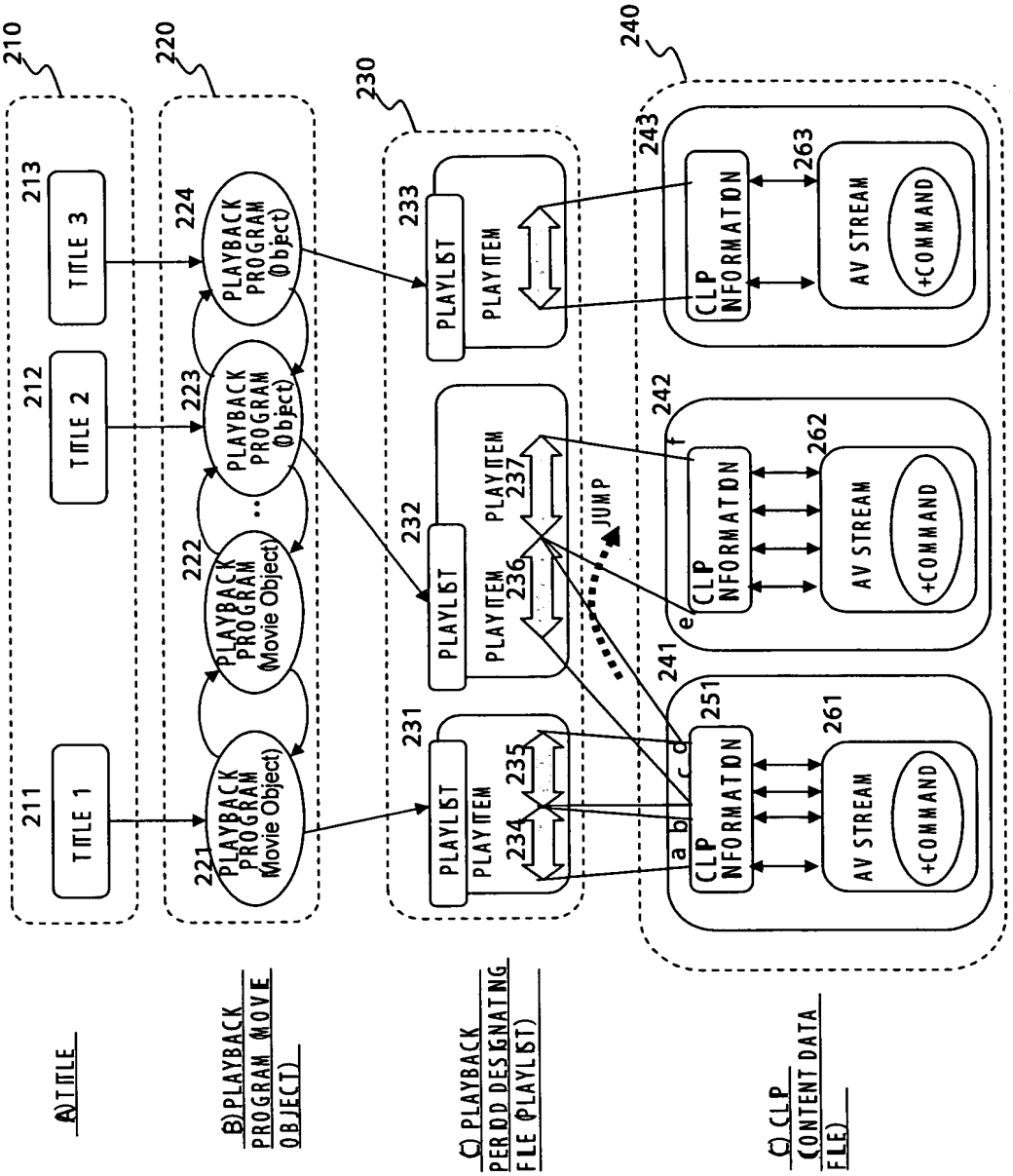
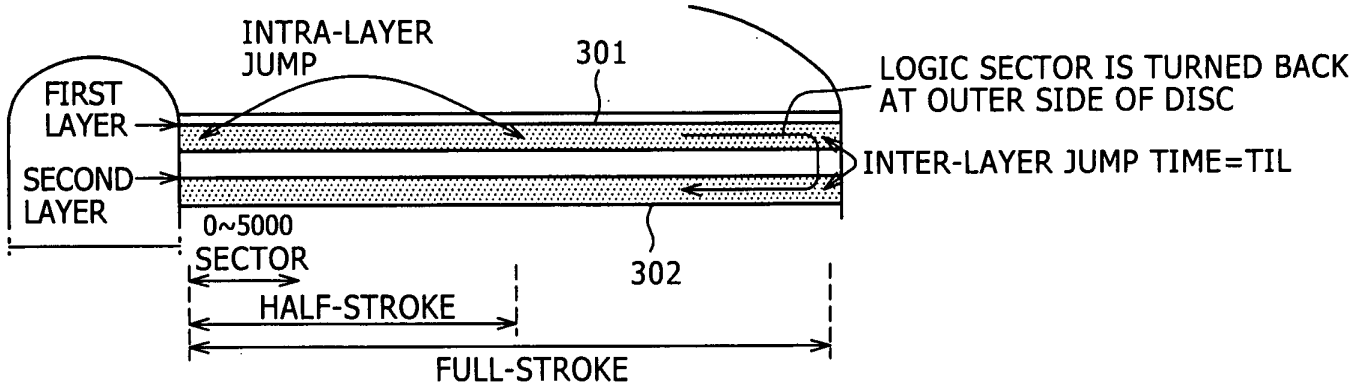

210
220
230
240
211
TITLE 1
212
TITLE 2
213
TITLE 3
221
PLAYBACK PROGRAM (Movie Object)
222
PLAYBACK PROGRAM (Movie Object)
223
PLAYBACK PROGRAM (Object)
224
PLAYBACK PROGRAM (Object)
231
PLAYLIST
PLAYITEM
234
235
232
PLAYLIST
PLAYITEM
236
PLAYITEM
237
JUMP
233
PLAYLIST
PLAYITEM
241
CLIP INFORMATION
251
AV STREAM
+COMMAND
261
242
CLIP INFORMATION
262
AV STREAM
+COMMAND
243
CLIP INFORMATION
263
AV STREAM
+COMMAND
a b c d
e
f
A) TITLE
B) PLAYBACK PROGRAM MOVE OBJECT)
C) PLAYBACK PERIOD DESIGNATING FILE (PLAYLIST)
D) CLIP (CONTENT DATA FILE)

FIG. 3

(a)



(1)

INTRA-LAYER JUMP TIME T_{ACC}

JUMP DISTANCE	0-5000 SECTOR	5000-10000 SECTOR	10000-20000 SECTOR	20000-40000 SECTOR	1/10 STROKE	1/3 STROKE	HALF-STROKE	FULL-STROKE
JUMP DATA SIZE [$\times 2^{20}$byte]	0~10	10~20	20~40	40~80	1000~	3000~	9000~	25000
INTRA-LAYER JUMP TIME TACC [ms]	179	210	270	330	650	880	990	1220

(2) INTER-LAYER JUMP TIME T_{IL} =360[ms]

(3) OVERHEAD TIME CAUSED AT READING OF ECC BLOCK BOUNDARY T_{OH}=20[ms]

TIME DATA SUPPLY IS STOPPED IN OCCURRENCE OF INTER-LAYER JUMP
$T_{JUMP}= T_{ACC}+ T_{IL} + T_{OH}$
IN CASE OF Full-stroke INVOLVING INTER-LAYER JUMP
T_{JUMP}= 1220m s+360ms+20ms = 1600ms

FIG. 4

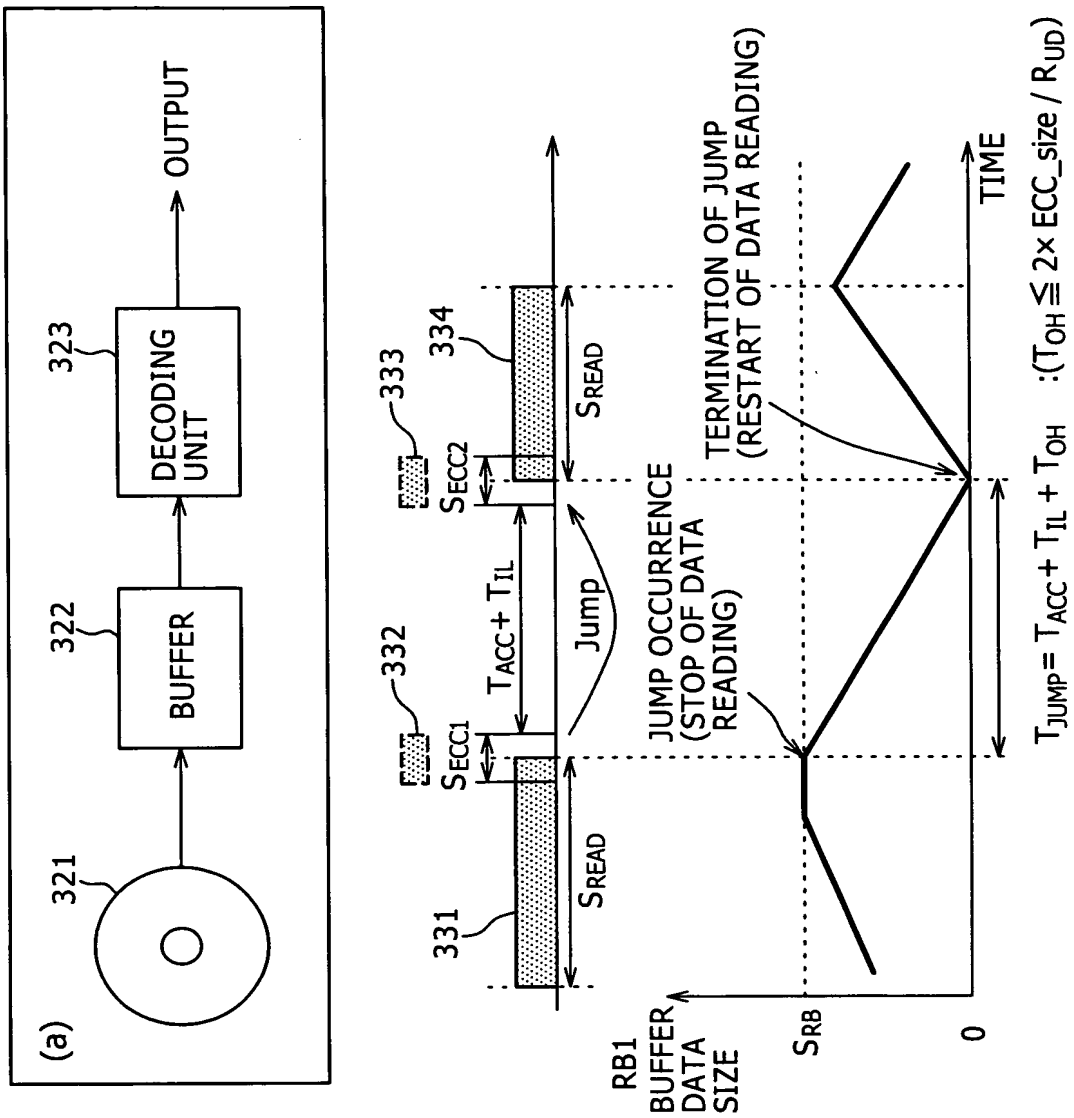

(a)
321
BUFFER
322
DECODING UNIT
323
OUTPUT
331
332
333
334
SECC1
SECC2
SREAD
SREAD
TACC+ TIL
Jump
JUMP OCCURRENCE (STOP OF DATA READING)
TERMINATION OF JUMP (RESTART OF DATA READING)
RB1
BUFFER DATA SIZE
SRB
0
TIME
TJUMP= TACC+ TIL + TOH :(TOH ≦ 2× ECC_size / RUD)

FIG. 5

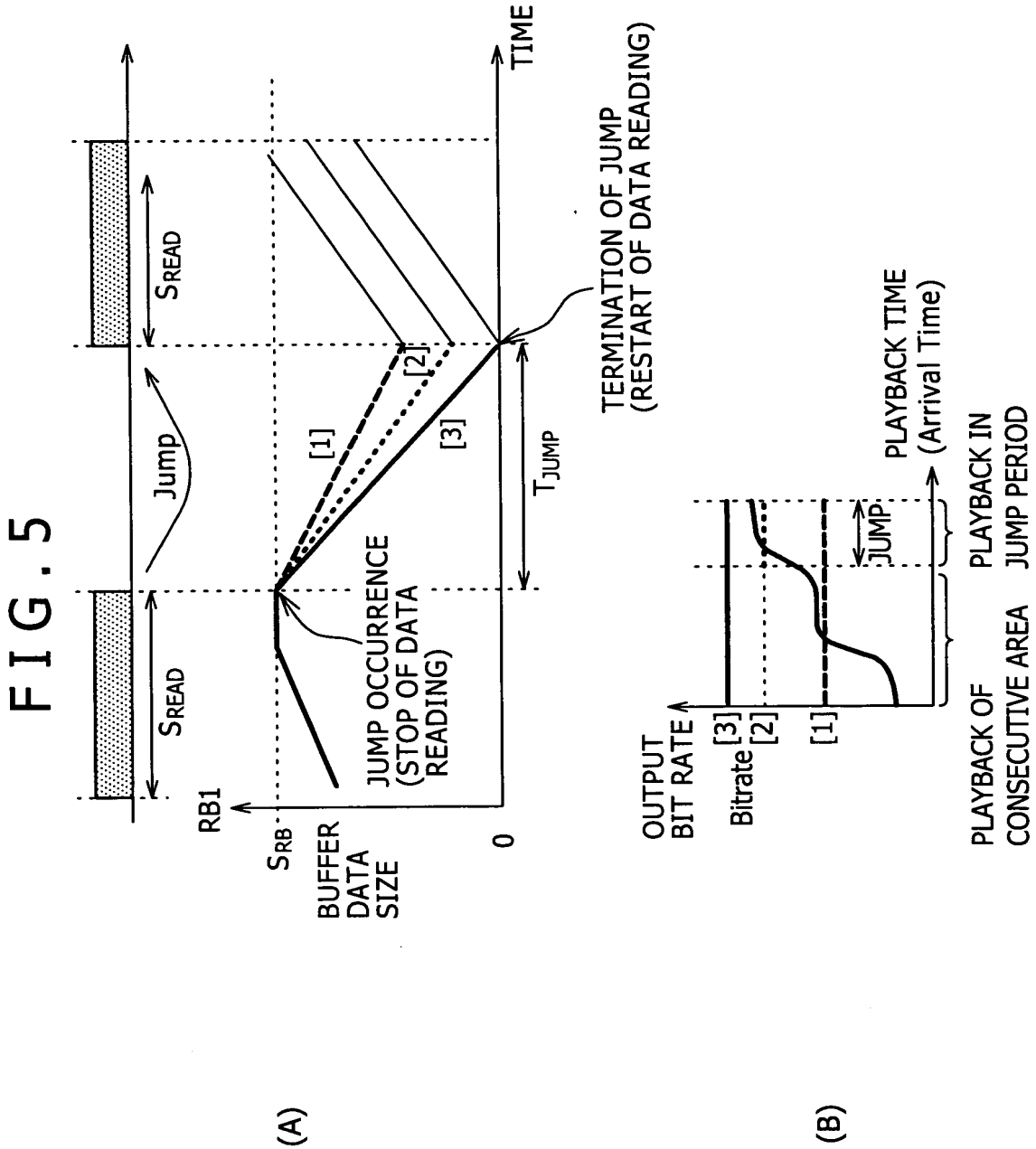

(A)
TIME
SREAD
SREAD
Jump
[1]
[2]
[3]
TJUMP
TERMINATION OF JUMP
(RESTART OF DATA READING)
JUMP OCCURRENCE
(STOP OF DATA
READING)
RB1
SRB
BUFFER
DATA
SIZE
0
(B)
OUTPUT
BIT RATE
Bitrate
[3]
[2]
[1]
JUMP
PLAYBACK TIME
(Arrival Time)
PLAYBACK OF
CONSECUTIVE AREA
PLAYBACK IN
JUMP PERIOD

FIG. 6

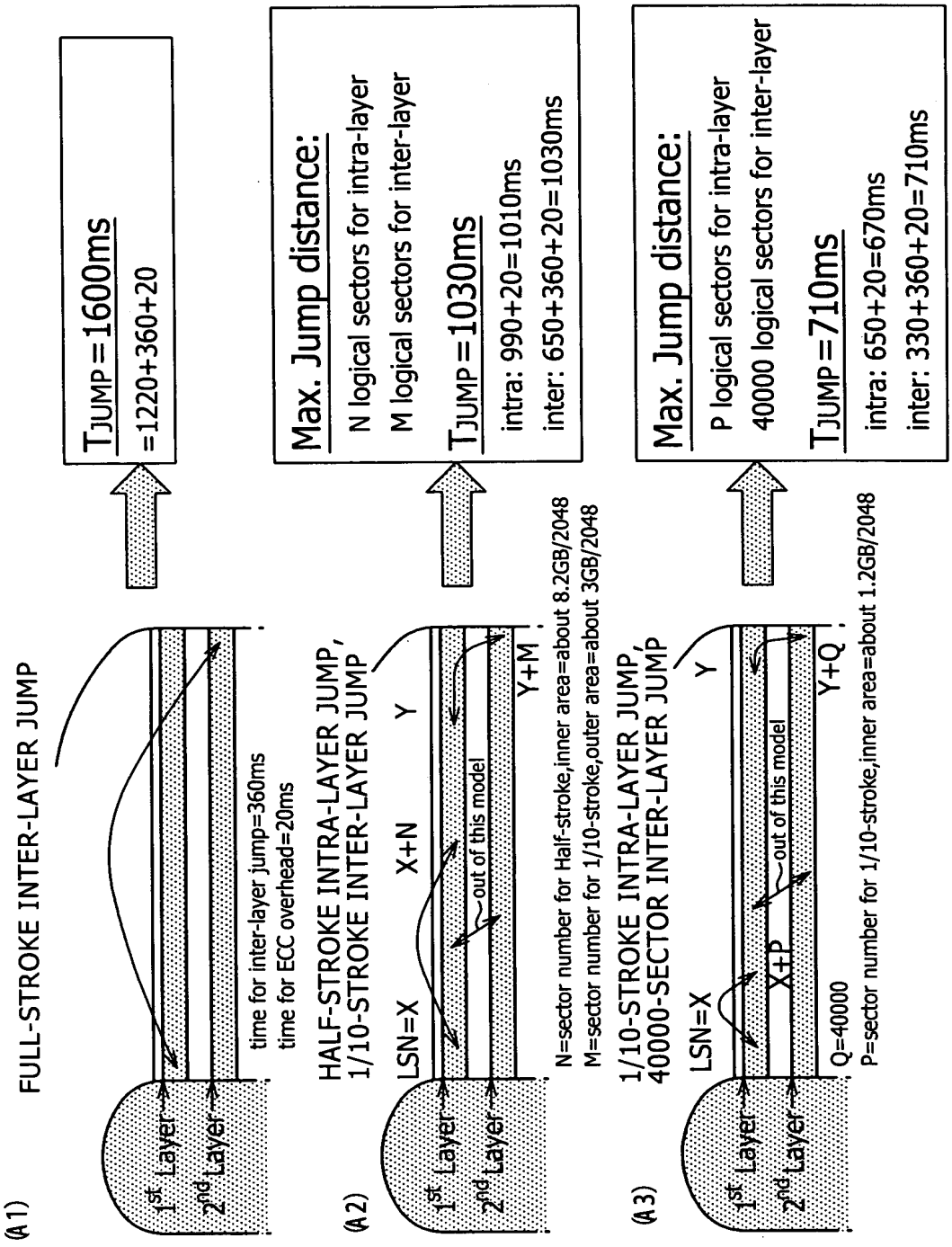

(A1) FULL-STROKE INTER-LAYER JUMP
1st Layer
2nd Layer
time for inter-layer jump=360ms
time for ECC overhead=20ms
TJUMP=1600ms
=1220+360+20
(A2) HALF-STROKE INTRA-LAYER JUMP,
1/10-STROKE INTER-LAYER JUMP
LSN=X
X+N
Y
Y+M
out of this model
N=sector number for Half-stroke,inner area=about 8.2GB/2048
M=sector number for 1/10-stroke,outer area=about 3GB/2048
Max. Jump distance:
N logical sectors for intra-layer
M logical sectors for inter-layer
TJUMP=1030ms
intra: 990+20=1010ms
inter: 650+360+20=1030ms
(A3) 1/10-STROKE INTRA-LAYER JUMP,
40000-SECTOR INTER-LAYER JUMP
LSN=X
X+P
Y
Y+Q
Q=40000
P=sector number for 1/10-stroke,inner area=about 1.2GB/2048
Max. Jump distance:
P logical sectors for intra-layer
40000 logical sectors for inter-layer
TJUMP=710ms
intra: 650+20=670ms
inter: 330+360+20=710ms

FIG. 7

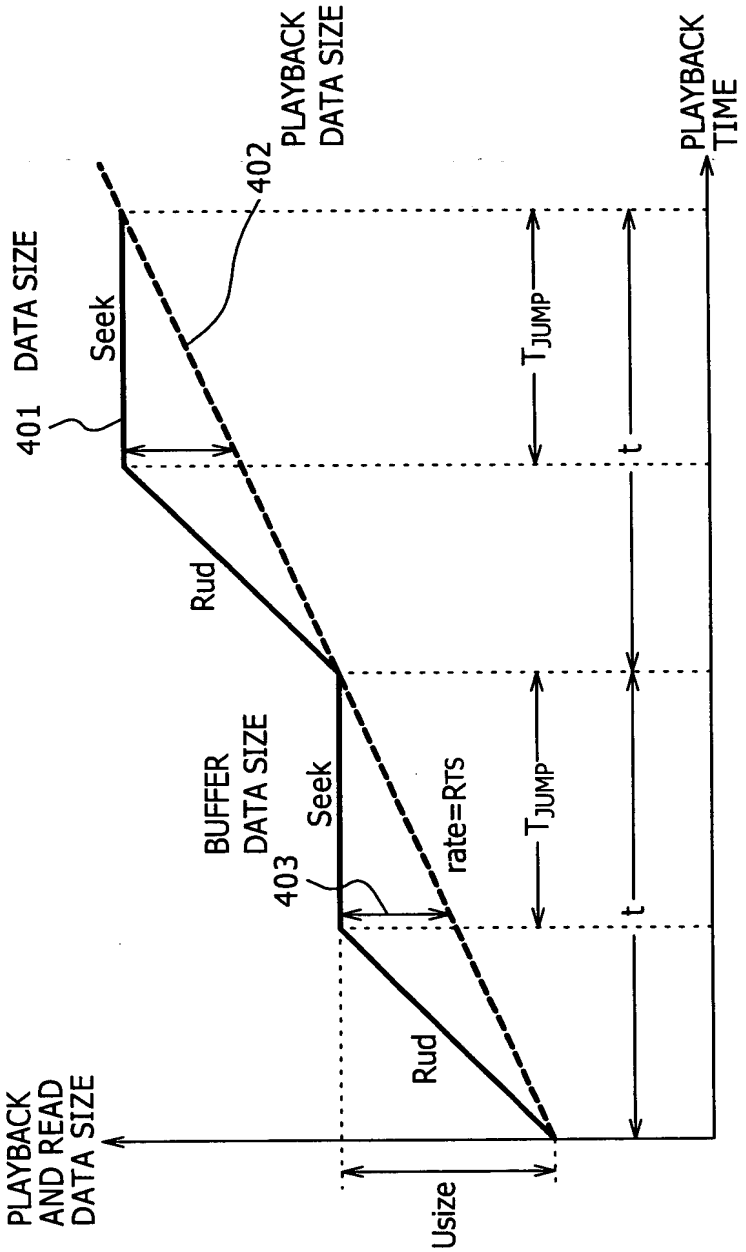

PLAYBACK DATA SIZE
PLAYBACK TIME
READ OUT DATA SIZE
402
401
Seek
T_{JUMP}
t
Rud
BUFFER DATA SIZE
Seek
rate=RTS
403
T_{JUMP}
t
Rud
PLAYBACK AND READ DATA SIZE
Usize

FIG. 8

COMPARISON PARAMETERS		(A1)	(A2)	(A3)
MAXIMUM JUMP TIME [T_{JUMP}]		1600ms	1030ms	710ms
BUFFER SIZE [S_{RB}]		9.36 MByte(*1)	6.02 MByte	4.15 Mbyte
MINIMUM DATA ARRANGEMENT SIZE REQUIRED TO GUARANTEE CONSECUTIVE SUPPLY OF DATA BEFORE AND BEHIND JUMP [Usize]	DATA RECORDING RATE (=TS_recording_rate x 192/188)	–	–	–
	5 x 192/188 Mbps	1.1 MByte	0.7 MByte	0.5 Mbyte
	10 x 192/188 Mbps	2.5 MByte	1.6 MByte	1.1 Mbyte
	20 x 192/188 Mbps	6.3 MByte	4.1 Mbyte	2.8 Mbyte
	30 x 192/188 Mbps	13.6 MByte	8.7 Mbyte	6.0 Mbyte
	40 x 192/188 Mbps	32.0 MByte	20.6 Mbyte	14.2 Mbyte
	48 x 192/188 Mbps	101.5 MByte	65.3 Mbyte	45.1 MByte

(*1)MByte = 2^{20}byte

FIG. 9

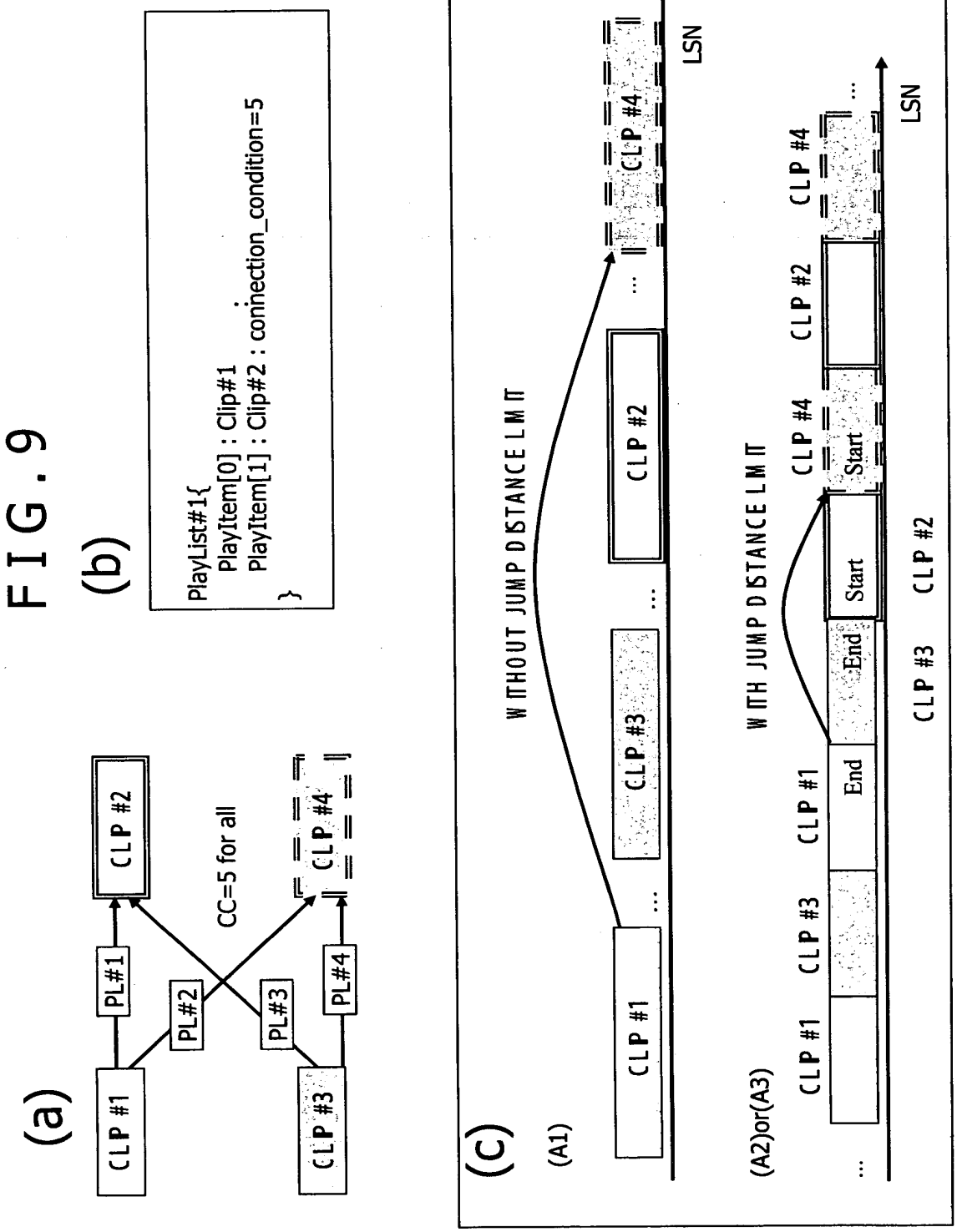

(a)
CLP #1
PL#1
CLP #2
PL#2
CC=5 for all
PL#3
CLP #3
PL#4
CLP #4
(b)
PlayList#1{
PlayItem[0] : Clip#1
PlayItem[1] : Clip#2 : connection_condition=5
}
(c)
WITHOUT JUMP DISTANCE LIMIT
(A1)
CLP #1
CLP #3
CLP #2
CLP #4
LSN
WITH JUMP DISTANCE LIMIT
(A2)or(A3)
CLP #1
CLP #3
CLP #1
End
End
Start
CLP #4
CLP #2
Start
CLP #4
CLP #3
CLP #2
LSN

FIG. 10

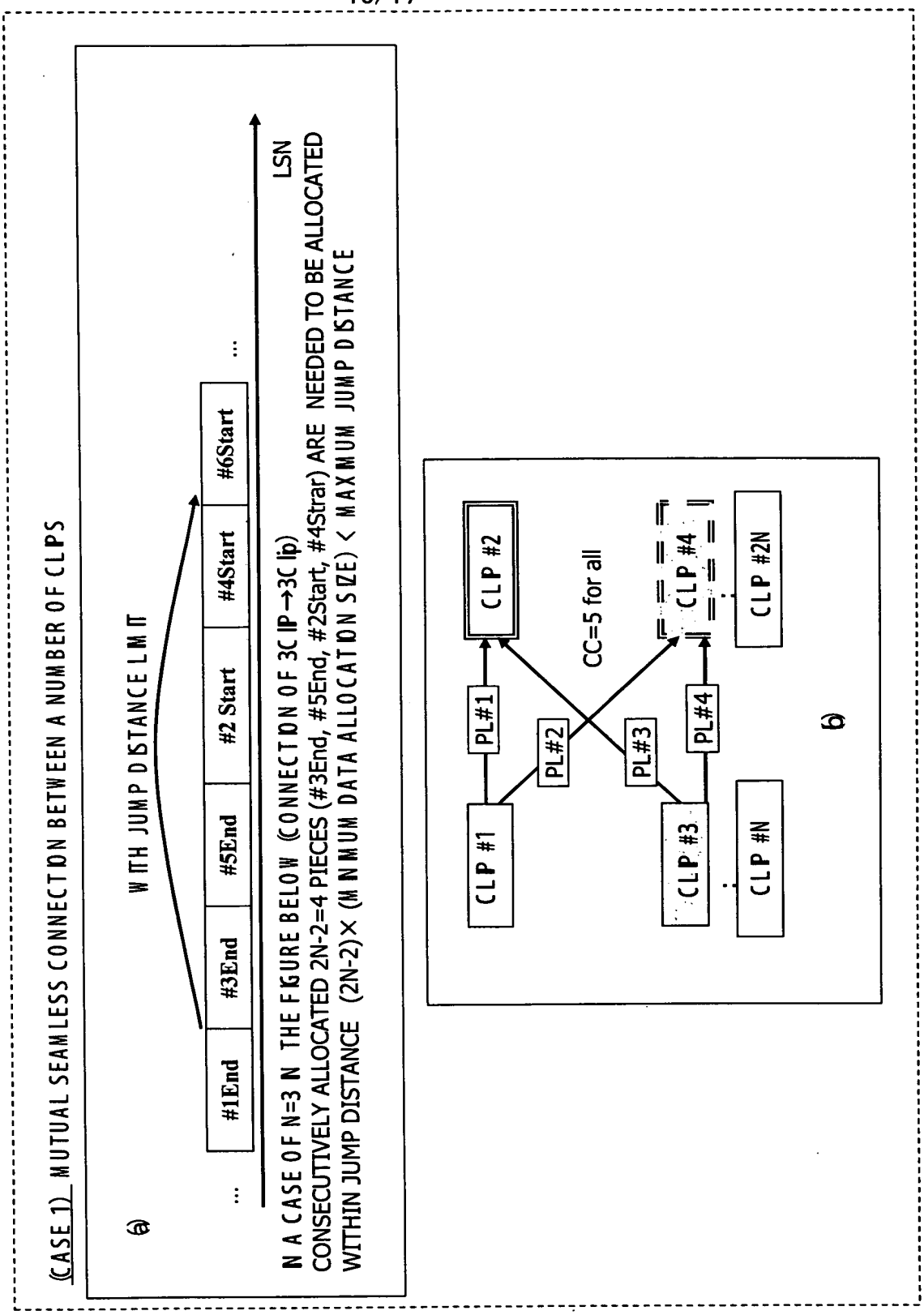

(CASE 1) MUTUAL SEAMLESS CONNECTION BETWEEN A NUMBER OF CLPS
(a)
WITH JUMP DISTANCE LIMIT
#1End
#3End
#5End
#2 Start
#4Start
#6Start
LSN
IN A CASE OF N=3 IN THE FIGURE BELOW (CONNECTION OF 3C IP→3C ip)
CONSECUTIVELY ALLOCATED 2N-2=4 PIECES (#3End, #5End, #2Start, #4Strar) ARE NEEDED TO BE ALLOCATED
WITHIN JUMP DISTANCE (2N-2)× (MINIMUM DATA ALLOCATION SIZE) < MAXIMUM JUMP DISTANCE
(b)
CLP #1
CLP #2
CLP #3
CLP #4
CLP #N
CLP #2N
PL#1
PL#2
PL#3
PL#4
CC=5 for all

FIG. 11

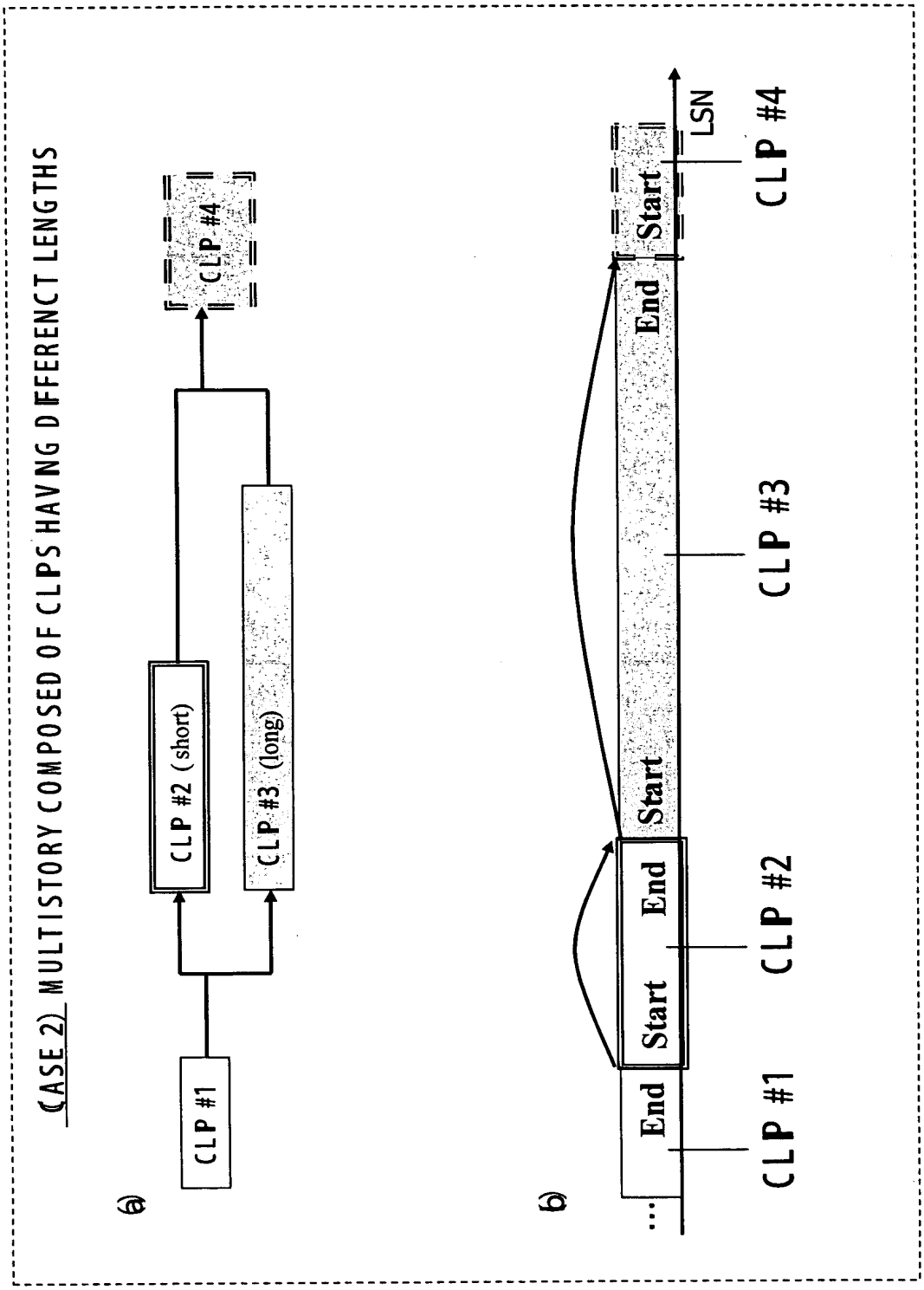

(CASE 2) MULTISTORY COMPOSED OF CLPS HAVING DIFFERENCT LENGTHS
(a)
CLP #1
CLP #2 (short)
CLP #3 (long)
CLP #4
(b)
End
Start
End
Start
End
Start
LSN
CLP #1
CLP #2
CLP #3
CLP #4

FIG. 12

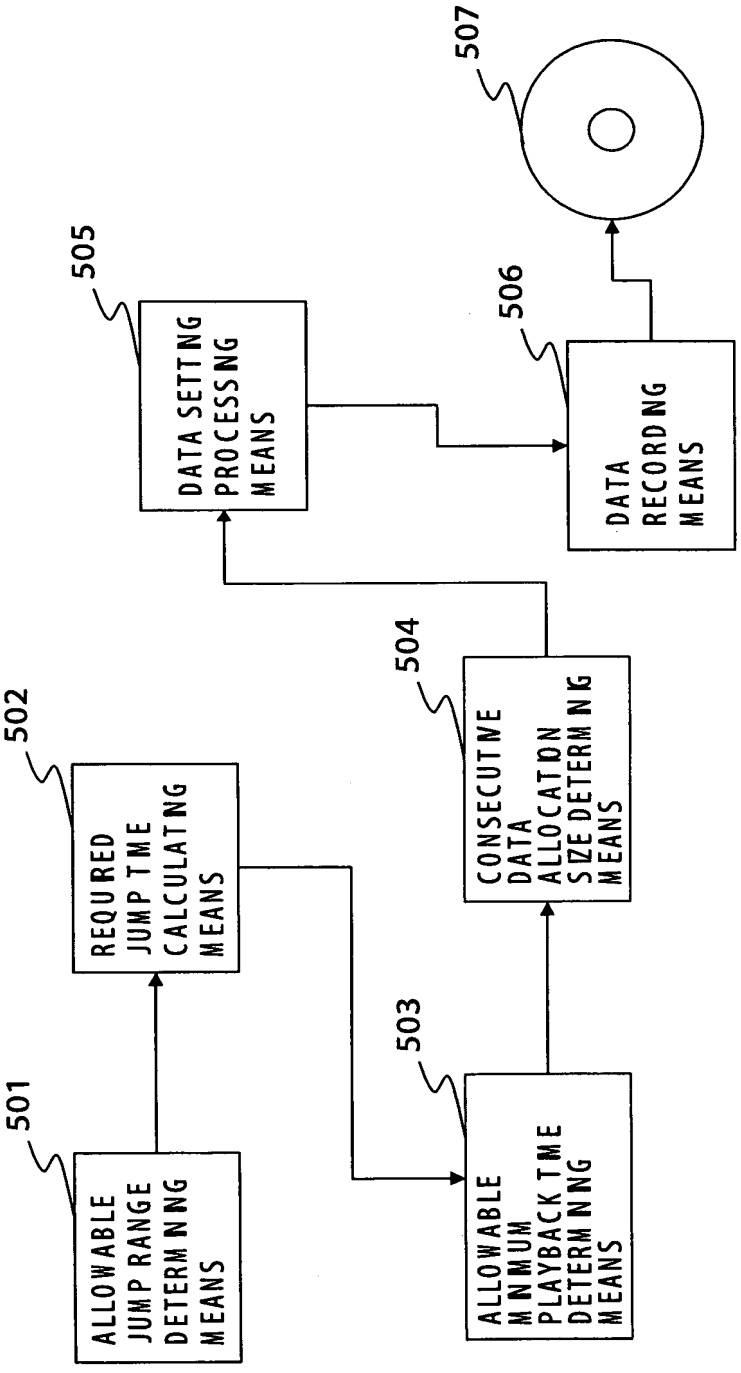

507
505
DATA SETTING PROCESSING MEANS
506
DATA RECORDING MEANS
504
CONSECUTIVE DATA ALLOCATION SIZE DETERMINING MEANS
502
REQUIRED JUMP TIME CALCULATING MEANS
503
ALLOWABLE MINIMUM PLAYBACK TIME DETERMINING MEANS
501
ALLOWABLE JUMP RANGE DETERMINING MEANS

FIG. 13

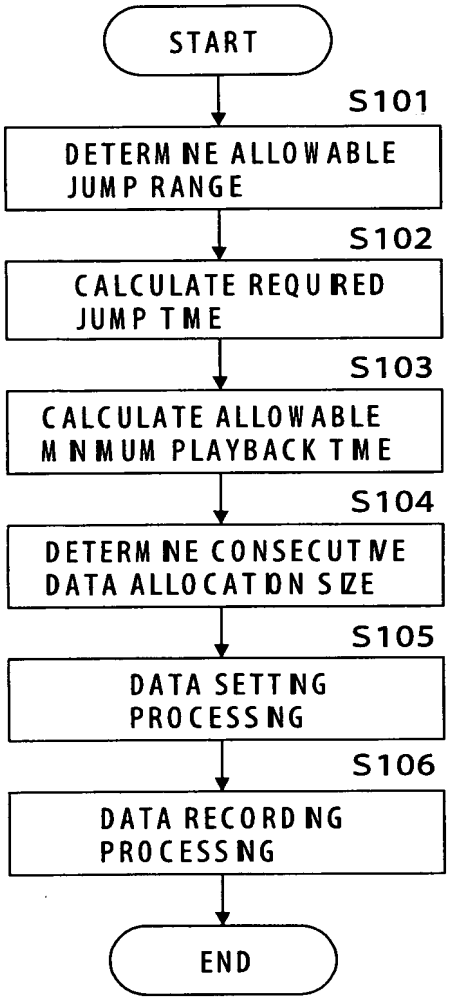

START
S101
DETERMINE ALLOWABLE JUMP RANGE
S102
CALCULATE REQUIRED JUMP TIME
S103
CALCULATE ALLOWABLE MINIMUM PLAYBACK TIME
S104
DETERMINE CONSECUTIVE DATA ALLOCATION SIZE
S105
DATA SETTING PROCESSING
S106
DATA RECORDING PROCESSING
END

FIG. 14

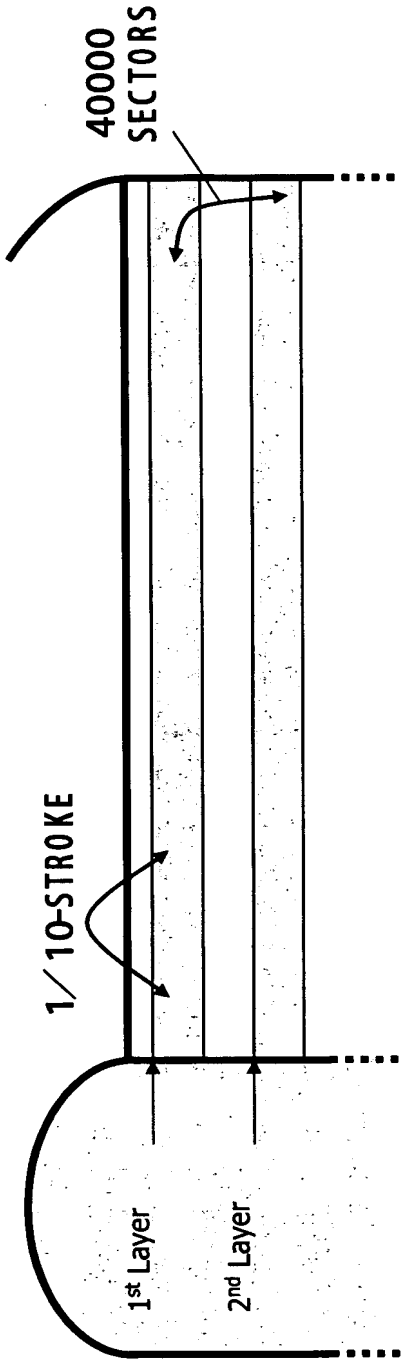


FIG. 15

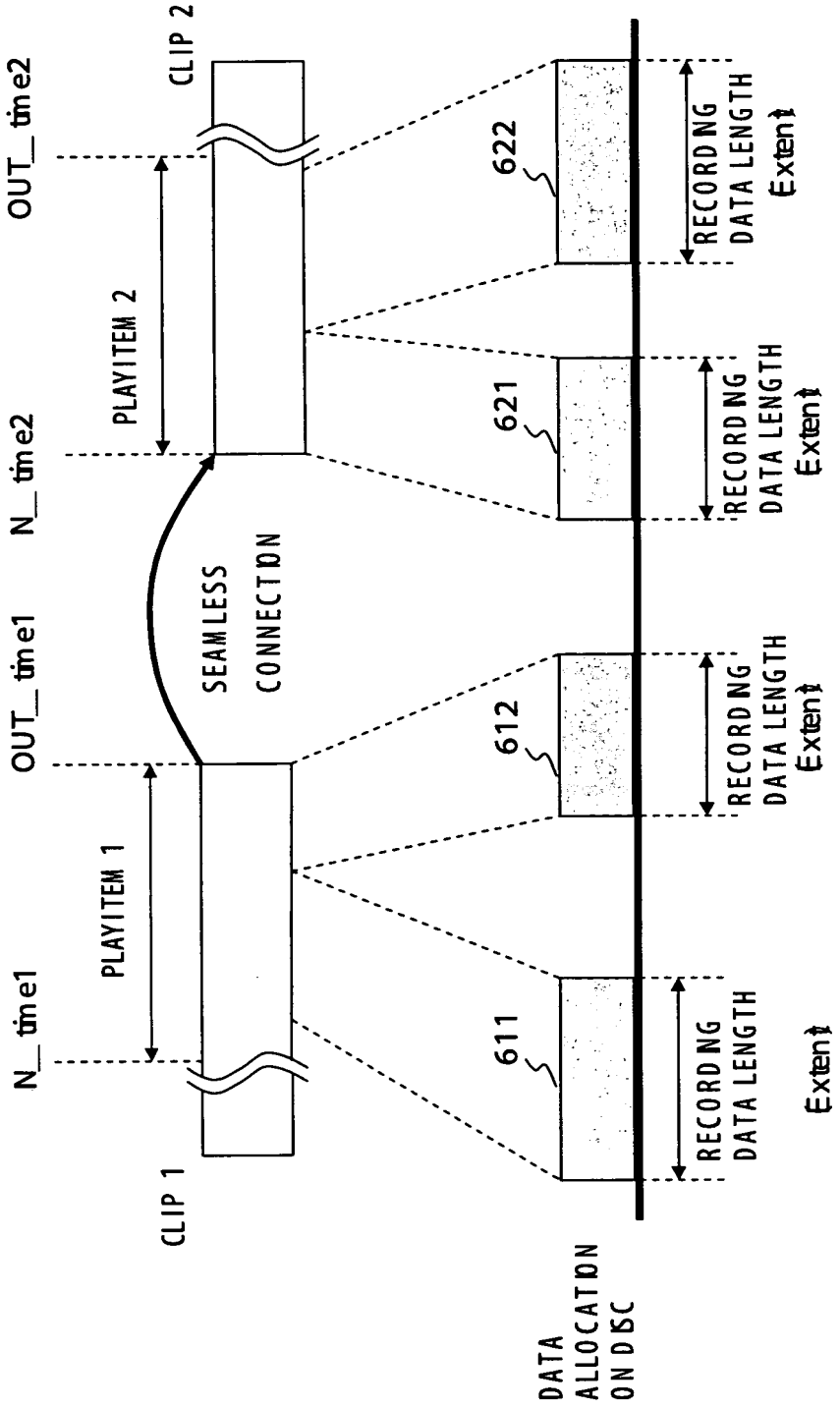
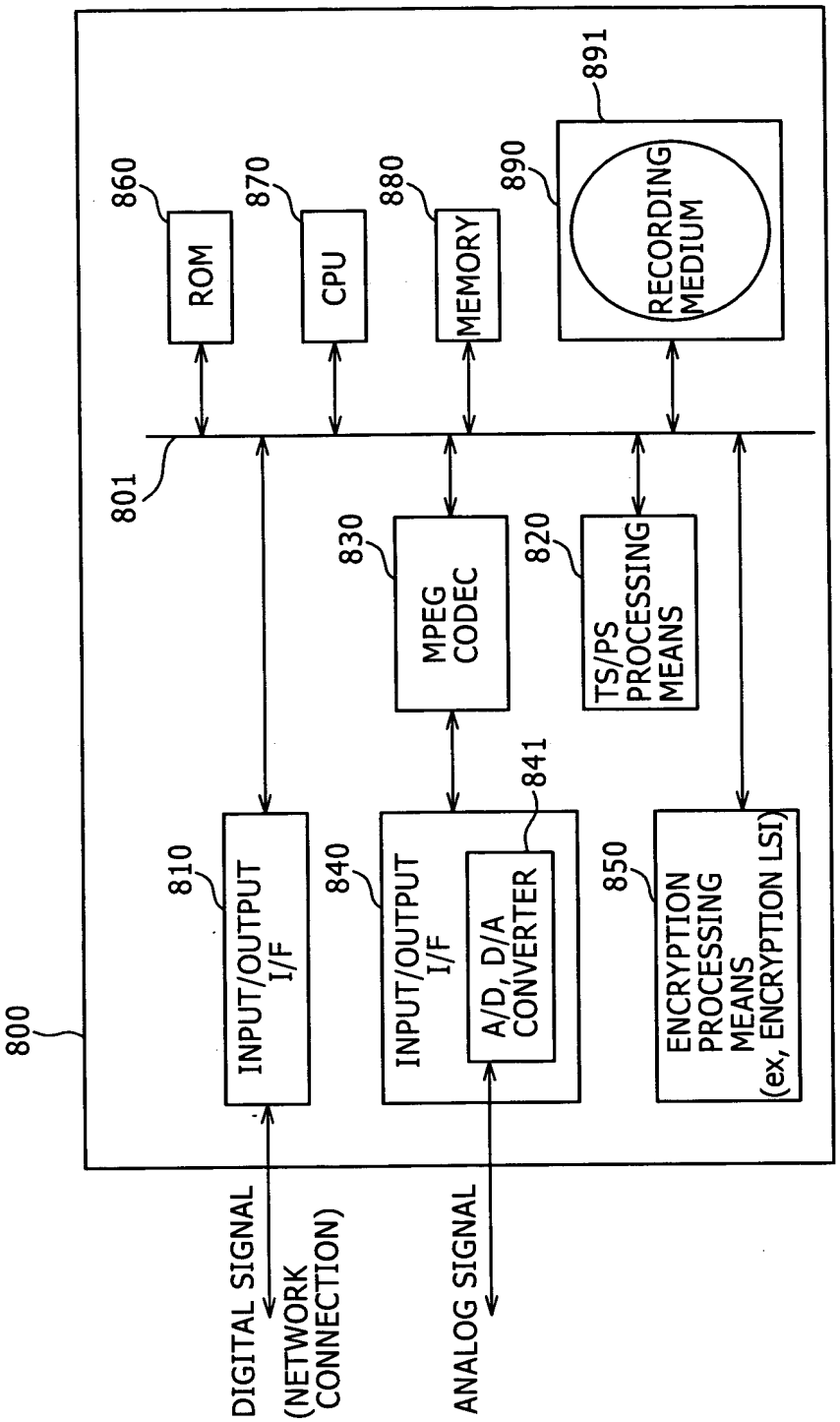

CLIP 2
OUT_time2
PLAYITEM 2
N_time2
SEAMLESS CONNECTION
OUT_time1
PLAYITEM 1
N_time1
CLIP 1
622
621
612
611
RECORDING DATA LENGTH
Extent
DATA ALLOCATION ON DISC

FIG. 16

TS_recording rate [RTS] bits/ second]	Minimum data recording size [Usize] Minimum Extent Size) Bytes]
5×10^6	0.5×2^{20}
10×10^6	1.1×2^{20}
20×10^6	2.8×2^{20}
30×10^6	6.0×2^{20}
40×10^6	14.2×2^{20}
48×10^6	45.1×2^{20}

FIG.17


800
801
810
INPUT/OUTPUT I/F
820
TS/PS PROCESSING MEANS
830
MPEG CODEC
840
INPUT/OUTPUT I/F
841
A/D, D/A CONVERTER
850
ENCRYPTION PROCESSING MEANS (ex, ENCRYPTION LSI)
860
ROM
870
CPU
880
MEMORY
890
RECORDING MEDIUM
891
DIGITAL SIGNAL (NETWORK CONNECTION)
ANALOG SIGNAL